

Scholia 2026: Compliance with SPARQL 1.1

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Abstract

Scholia is a specialized portal that uses a combination of SPARQL and the Flask Python platform to visualize data from Wikidata. In this demonstration, we will show how Scholia works and how the Scholia team made it independent from the Blazegraph-based Wikidata Query Service (WDQS) over the past eighteen months. This had become necessary due to a forced Wikidata graph split in 2025, which affected Scholia because most of its SPARQL queries were tuned towards the WDQS dialect of SPARQL. The project explored various options, including writing federated SPARQL queries using the new functionalities provided by the split WDQS, but here, we discuss a concerted effort to make Scholia queries compatible with a SPARQL 1.1 compliant engine, QLever.

Keywords

Scholia, Wikidata, SPARQL, Python

Wikidata is a crowd-curated platform providing general reference information in a semantic format [1]. Its official SPARQL service, the Wikidata Query Service (WDQS), has historically relied on the Blazegraph engine to evaluate queries [2]. However, as Wikidata grew to over 17 billion triples, its Blazegraph backend has reached significant performance limits. This led the Wikimedia Foundation to split the query service into two parts in 2025: WDQS-main, containing roughly 8.6 billion triples of general data, and WDQS-scholarly, containing 8.7 billion triples related to scholarly articles [3].

Scholia [4] is a specialized portal for the scientific community that serves Wikidata content through a set of 387 precomposed SPARQL query templates organized into over 40 profile types, known as aspects. These cover general entities such as authors, works, venues, organizations, events, and event series, as well as more special ones like taxa, diseases, chemicals, genes or proteins [5]. Because Scholia's queries frequently require data from both the general and scholarly Wikidata subsets, the split posed a critical challenge to the continuation of the service. As an interim solution, the Wikimedia Foundation continued to provide a Blazegraph instance with the unified full graph until 20 January 2026. Preparing for this change, the Scholia team investigated three primary recovery routes, ultimately selecting the third one:

1. Modifying existing queries to use SPARQL federation to communicate between the two split endpoints. This was found to be impractical, as inter-service communication led to severe performance degradation and the loss of optimization opportunities [3].
2. Using snapQuery middleware [6] to generalize query access across endpoints.
3. Remove any Blazegraph-specific constructs in Scholia and instead changing all the queries to standard SPARQL 1.1. This allows the use of any SPARQL 1.1 engine that can effectively evaluate queries against the entire Wikidata graph, including QLever [7], MilleniumDB, and Virtuoso, not

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only obviating the need to switch to a split-service architecture with its inherent inefficiencies but also leveraging modern engines that are considerably faster than Blazegraph.

A fork of the original Scholia project was created [8] to collaborate on the necessary modifications, around which several hackathons were organized [9]. A decision was made to use a Wikidata query service (<https://qllever.dev/api/wikidata>) powered by QLever [7]. This decision was supported by benchmarking multiple SPARQL backends [10], of which QLever was fastest overall.

The bulk of the work was eliminating non-standard constructs from query templates. The major types of these constructs were: named sub-queries; the Blazegraph locality service that finds nodes with a geographic property value near a given geographic point; the Blazegraph gather-scatter service that finds nodes in the vicinity of a node reachable by a property; the Wikibase service allowing communication with the MediaWiki API for e.g. searching full text contents of Wikipedias; and the Wikibase label service that finds the property value that has the most-preferred language. These non-standard constructs had largely been used to improve query evaluation. Other systems using the WDQS also use non-standard constructs to get around problems with query termination caused by the slowness of Blazegraph.

Named sub-queries were eliminated by substituting the named query where it was referenced. The locality service was eliminated by unrestricted querying and then filtering based on computed distances. The gather-scatter service was mostly eliminated by using transitive closure and filters or limits. Perhaps the most problematic construct to eliminate was the Wikibase label service, as it involves preference. Based on suggestions from Hannah Bast, the leader of the QLever team, Jinja templates were implemented that generate standard SPARQL 1.1 constructs to efficiently determine the best labels or descriptions. The templates take a Wikidata item plus a sequence of language codes and the generated SPARQL effectively iterates over the language codes, and returns the label with the first language code for which the item has a label or description in that language code. Versions of the templates had to be written to work well with unbound query variables, as can arise in queries with OPTIONAL.

In general, though the process took about eighteen months, the overall results are quite satisfactory, and the QLever-based setup exhibits improved performance compared to the original Blazegraph one. While the official Scholia service is yet to be updated to use the new QLever-based setup, our effort shows that it is generally possible to adjust any system that uses the WDQS to instead use standard SPARQL 1.1 queries. The Wikimedia Foundation is looking into making its official Wikidata Query Service SPARQL 1.1. compliant, too. If they choose a service other than QLever, the Scholia queries may need some further adjustments.

The demo at SWAT4HCLS will show various Scholia aspects, e.g. for the SWAT4HCLS event series, along with opportunities to investigate the changes made in the conversion and effects of using QLever.

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Declaration on Generative AI

Some author(s) have occasionally employed Generative AI tools for the changes in the Scholia code. All code changes have been reviewed by another person.

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